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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,638	08/18/2003	Peng Zhou	COOL-01500	4432

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EXAMINER
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EARLY, MICHAEL JACOBY

ART UNIT	PAPER NUMBER
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3744

DATE MAILED: 01/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/643,638

Applicant(s)

ZHOU ET AL.

Examiner

Michael J. Early

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>4/29/04; 1/26/05</u> . | 6) <input checked="" type="checkbox"/> Other: <u>PTO-1449 or PTO/SB/08 (2/1/05)</u> .   |

## **DETAILED ACTION**

### **Claim Rejections – 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which form the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al. ("Modeling of Two-phase microchannel Heat Sinks for VLSI Chips"), in view of Yamaguchi (JP 01-256775).

Koo et al. discloses applicant's basic inventive concept, a method of cooling a heat-generating device (IC Chip, Figure 1), using a pump (Electrokinetic pump, Figure 1) to cause a fluid flow in a heat exchanger (Microchannel Heat Exchanger, Figure 1) and having a heat rejector (Condenser, Figure 1) for rejecting heat from the system, located downstream from the heat exchanger. Koo et al. further disclose that both the pressure drop and pump power are dependent upon the mass flowrate of the flowing fluid within the system (see page 425, last paragraph).

However, Koo et al. do not disclose:

- the pressure of the refrigerating fluid is adjusted in the system to correspondingly adjust the boiling point temperature of the fluid in the heat exchanger.

Yamaguchi teaches that adjusting the pressure of the refrigerating fluid in the heat exchanger will correspondingly adjust the boiling point temperature of the refrigerant for evaporation cooling, via a relief valve (5), to be old in the refrigeration art (see constitution).

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Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al., by adjusting the pressure of the refrigerating fluid to correspondingly adjust the boiling point temperature of the refrigerant, as taught by Yamaguchi, in order to: provide efficient cooling of the system and permit higher fluid temperatures, which in turn would maximize the heat exchanging capability of the apparatus (see constitution).

Claims 2, 27 and 28 rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Takahashi et al. (U.S. 6,182,742).

However, Koo et al. in view of Yamaguchi do not disclose:

- the pressure of the refrigerating fluid is adjusted in the system by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid.

Takahashi et al. teach adjusting pressure of the refrigerating fluid in the system by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid (temperature sensors, located at the distribution header, prior to entering the heat exchanger; col. 7, lines 15 – 22 and col. 8, lines 12 – 18) to be old in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid, as taught by Takahashi, in order to adjust the pressure of the refrigerating fluid in the system prior to it entering the heat exchanger.

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Claims 3, 14 – 21, 26, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Wightman (U.S. 2003/0121274).

However, Koo et al. in view of Yamaguchi do not disclose:

- the pressure of the refrigerating fluid is adjusted in the system by adjusting an orifice coupled to the heat exchanger in response to the change in the temperature of the fluid.

Wightman shows adjusting pressure of the refrigerating fluid in the system by adjusting an orifice (18, Figure 1) coupled to the heat exchanger (14, Figure 1) in response to the change in the temperature of the fluid (32) to be old in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by adjusting pressure of the refrigerating fluid in the system by adjusting an orifice coupled to the heat exchanger prior to it entering the heat exchanger, but based on the temperature of the fluid after the heat exchanger with the heat generating device, as taught by Wightman, in order to have a precise and rapid response of the orifice to variations in volumetric expansion rate [0005].

Also, Koo et al. in view of Yamaguchi do not disclose a particular type of refrigerant used, be it water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia, as claimed by the applicant. Wightman shows that water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia (0046), to be refrigerants common in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by specifying the type of refrigerant used, as taught by Wightman, in order to make the product more user- and environment-friendly.

Claims 5 – 7 and 9 – 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Tilton et al. (U.S. 2004/0089008).

However, Koo et al. in view of Yamaguchi do not disclose:

- the use of a reservoir to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the heat rejector and upstream from the pump.

Tilton et al. teach the use of a reservoir (25, Figure 2) to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the heat rejector (30, Figure 2) and upstream from the pump (40, Figure 2) to be old in the refrigeration art. Also, since the reservoir is used to store the vapor, it would be an obvious design choice to have such tank at a sufficient volume to contain the maximum amount of gas generated in the heat exchanger. Finally, the applicant is reminded that the use of a one piece construction instead of the structure disclosed in Tilton et al. would be merely a matter of obvious engineering choice, *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by using a reservoir, integral with the heat rejector and the pump, as taught by Tilton et al., to accommodate gas generated during boiling in order to reduce the change in pressure and prevent possible pump cavitation [0053].

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Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Tilton et al., as applied to claim 5 above and still further in view of Cowans (U.S. 6,775,996).

Koo et al. in view of Yamaguchi and further in view of Tilton et al. do not disclose:

- the reservoir is upstream of the heat rejector.

Cowans teaches the use of a reservoir (92, Figure 2) to accommodate gas generated during boiling, said reservoir being upstream from the heat rejector (44, Figure 2) to be old in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi and further in view of Tilton et al., by using a reservoir to accommodate gas generated during boiling upstream of the heat rejector, as taught by Cowans, in order to use the gas as a heat exchanging fluid for another purpose (subcooler 52, Figure 2).

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Chesser et al. (U.S. 2004/0040695).

However, Koo et al. in view of Yamaguchi do not disclose:

- the system is hermetically sealed, where the pressure varies less than 1 psi during a five year lifetime.

Chesser et al. teach the use of a hermetically sealed pumped loop cooling system [0042] to be old in the refrigeration art. Also, any hermetically sealed system is completely sealed, which provides no variations in the pressure, including a change in pressure of 1 psi.

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Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by using a hermetically sealed pumped loop cooling system, as taught by Chesser et al., in order to prevent outside elements from factoring in the cooling variations and the systems performance (sub-atmospheric conditions, [0042]).

Claims 22 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Gold (U.S. 6,023,934).

However, Koo et al. in view of Yamaguchi do not disclose:

- a particular type of refrigerant used, be it a hydrocarbon like methane, or a cryogenic like helium.

Gold teaches the use of a hydrocarbon like methane (see col. 4, line 12), or a cryogenic like helium (see col. 1, lines 18 – 19) as a refrigerant to be used in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by specifying the type of refrigerant used, as taught by Gold, in order to make the product more user- and environment-friendly.

Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koo et al., in view of Yamaguchi, as applied to claim 1 above, and further in view of Kiang et al. ("A Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits").

However, Koo et al. in view of Yamaguchi do not disclose:

- using an electroosmotic pump as pumping means and a catalytic recombiner, coupled to the inlet port of the pump, wherein the hydrogen and oxygen are combined to produce water.



Jiang et al. teach the use of an electroosmotic pump (see page 4, lines 6 – 8) as pumping means and a catalytic recombiner (as seen in Figure 8) to be old in the refrigeration art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Koo et al. in view of Yamaguchi, by using an electroosmotic pump as pumping means, as taught by Jiang et al., since electroosmotic pumps do not require any movable parts and are very compact (see page 4, line 8), and a catalytic recombiner, coupled to the inlet port of the pump in order to recombine the gas during electrolysis (see page 9, lines 1 – 2).

#### **Response to Arguments**

Applicant's arguments filed 11/14/05 have been fully considered but they are not persuasive.

The applicant states that Yamaguchi's boiling point adjustments rely on evaporative cooling, and thus do not teach or suggest that such adjustment would be desirable or even effective in convective cooling. This argument is not persuasive because the distinction between evaporative and convective cooling is not stated in the claim.

The applicant states that Yamaguchi does not teach, hint or suggest that the flowing fluid pressure be adjusted to correspondingly adjust the boiling point temperature of the fluid. This argument is correct; however, the combination of Koo et al. in view of Yamaguchi does provide this teaching.

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Although Yamaguchi teaches of stopping a circulating pump before allowing the boiling point of the refrigerant to be adjusted by the pressure of the refrigerant, Koo et al. disclose of a method of cooling a heat-generating device with a pump **to cause fluid to flow** in a heat exchanger and having a heat rejecter. Thus for one of ordinary skill in the art at the time of the invention, the combined teaching would have been sufficient to meet the claim.

### **Conclusion**

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Early whose telephone number is (571) 272-3681. The examiner can normally be reached on Monday - Friday, 7am - 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler can be reached on (571) 272-4834. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MJE  
1/6/06

Michael J. Early  
Patent Examiner  
Art Unit 3744



**CHERYL TYLER**  
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